

REMARKS

This paper is responsive to the Office Action mailed from the United States Patent and Trademark Office on August 22, 2007, wherein pending 1-13 and 15-24 claims were rejected.

35 U.S.C. § 102

Claims 1, 2, 4, 7-9, and 15-24 were rejected under 35 U.S.C. § 102(e) as being anticipated by Kruger (204/0127783). In particular, the Office Action suggests that Kruger discloses a system and method for localization of fluorescence in a scattering medium including an ultrasonic scanning system for generating ultrasonic pulses." (Office Action at page 2.) Paragraphs [0023] and [0029-0300] were cited in the Office Action to support the conclusion that ultrasonic pulses are generated in the Kruger methods, which are reproduced below:

[0023] FIG. 1 illustrates a commercial, linear array 8 **arranged for testing as a photoacoustic detector** (specifically, Model No. L538, available from Acuson, Mountain View, Calif.). This array comprises 128 elements spanning 38 mm. The elements have a nominal central frequency of 5 MHz, and are spaced 0.3 mm apart. Each element is nominally 6-mm high, with a thin acoustic lens that produced a geometric focus approximately 15 mm in front of the array

[0028] The **L538 array was connected to a 128-channel digital acquisition system** (DAS). The DAS had a 10 MHz analog bandwidth. All 128 channels were digitized to 10-bit precision at a sampling rate of 20 MHz for 1024 time samples. The DAS captured photoacoustic data at 1 or 16 angles spanning 360 degrees. Signal averaging (16 pulses) was performed at each angle.

[0029] Photoacoustic images were reconstructed using a filtered-backprojection algorithm described in the above-referenced U.S. patents. To implement this algorithm, the first derivative of the recorded photoacoustic signals for each transducer element and each angle were back-projected over circular arcs centered at each transducer element's location. The radii of the arcs were proportional to the delay times between the laser's Q-switch trigger and the recorded photoacoustic signals, where **the constant of proportionality was the temperature-dependent velocity of sound**

in water. Two-dimensional images were reconstructed on a 256.times.256 grid of 0.1-mm pixels.

[0030] For **ultrasound image formation, the output of the L538 array** was connected to an Acuson 128 XP ultrasound imaging system, which was operated according to manufacturer's instructions. (Emphasis added)

As the cited paragraphs show, Kruger uses the L538 photoacoustic device to detect ultrasound signal; not to generate an ultrasonic pulse to "induce a modulated optical signal" as is required by each of the pending claims. Moreover Kruger detects ultrasound—not "modulated optical signal," which is also required by each of the pending claims.

The Office Action cited paragraph [0027] of Kruger to support the conclusion that Kruger teaches using an optical detection system including "a light collection and delivery system including at least one optical fiber for delivering collected light from the scattered medium to the detector such as a photoacoustic detector." (Office Action at page 3.)

[0027] A photoacoustic apparatus 10, suitable for in vivo imaging of small animals and small tissue samples, is illustrated in FIG. 2. The specimen to be evaluated is contained in a water-filled, rectangular imaging tank 12 fabricated from clear plastic. The L538 array 8 was embedded in one side of the tank. During the test imaging described below, phantoms to be imaged were positioned within an approximately 20-mm diameter, cylindrical volume constructed of 0.004" thick FEP plastic. This plastic "cylinder" was attached to mandrels 14 top and bottom. The top mandrel was affixed to a rotary stage 17 that could be rotated through 360 degrees. **Light from a Nd:YAg laser (not shown) was fed to a fiber-optic light guide, which was split into two linear sources (1".times.0.070" "light lines" 16), and illuminated the imaging volume from opposing directions as illustrated in FIG. 2.** The light lines were positioned vertically to lie near the imaging plane of the transducer array. **The light output** from each light line was .about.5 mJ/pulse. The laser was pulsed at 10 Hz during data acquisition. (Emphasis added.)

Paragraph [0027] teaches using a laser as a light source and does not

describe an optical detection step or system. Indeed, the photoacoustic system described by Kruger uses "a source of illumination, such as a laser, directs light to the mouse through the coupling media, and resulting acoustic waves are capture by the array and reconstructed to form an image." (Kruger Abstract.) Kruger does not even contemplate detecting optical signal.

Kruger fails to teach at least two of elements required by the pending claims: generating an ultrasonic pulse to induce an acoustic lens to modulate the optical signal and detecting the resulting modulated optical signal. Accordingly, applicant submits that Kruger fails to anticipate the pending claims.

35 U.S.C. § 103

Claim 3 stands rejected as being rendered obvious by the combination of Kruger and Ogawa. Claims 5 and 6 stand rejected as obvious as being rendered obvious by the combination of Kruger and Sfez. Claims 10, 11, and 12 stand rejected as being rendered obvious by the combination of Kruger and Nelson (6,216,540). Claim 13 stands rejected as being rendered obvious by the combination of Kruger and Schmid.

Each of the § 103 rejections rests on the assertion that Kruger substantially discloses the claimed invention. Applicants submit that Kruger fails to disclose the claimed invention in which fluorescence in a scattering medium is localized by: (1) illuminating a scattering medium with an excitation light, (2) modulating a portion of the emitted light from the fluorescence within the scattering medium using an ultrasonic pulse to induce an acoustic lens to generate a modulated optical signal; and (3) detecting the modulated optical signal at a surface of the scattering medium. And, none of the secondary references cure Kruger's deficiencies. Accordingly, applicant submits that Kruger neither anticipates nor renders the pending claims obvious.

CONCLUSION

Applicants request that Examiner Roy reconsider the application and claims in light of the foregoing Remarks, and respectfully submit that the pending claims are in condition for allowance. If, in the Examiner's opinion, a telephonic interview would expedite the favorable prosecution of the present application, the undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Applicants believe that additional fees are necessitated by the present Amendment. However, in the event that any additional fees are due, the Commissioner is hereby authorized to charge any such fees to Attorney's Deposit Account No. 07-0868.

Respectfully submitted,

/Maureen A. Bresnahan/

Maureen A. Bresnahan
Attorney for the Applicants
Reg. No. 44,559

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General Electric Company
Building K1, Room 3A64
Niskayuna, New York 12301

Telephone: (518) 387-5115 or
(518) 387-6304